WALK AROUND

FRONT	Windscreen no cracks (Clean) No oil or water leaks under engine
SIDE (Drivers)	# 3 Points of contact to step into truck **LOOK, FEEL STEP** **Always back out**. Never jump out forward • Oil dip stick • Open front (water, Windscreen washer • Condition of tyres and wear • Check wheel nuts • Front springs for cracks f • Tray body sitting flat on rails • Drain air tanks 1. • Rear Duals o Rocks caught in duals o Wheel studs o Tyre pressure, inside tyre may be flat o Rear springs – any cracks
REAR	• Mudflaps condition • Indicator lens (No cracks) • Reverse lights • Brake lights • Spring brakes (Explain if you lose air, brakes come on)
SIDE (Passenger)	• Rear Duals o condition of tyres and any rock in duals • Anything hanging down • Front tyres - condition and wear and wheel studs • Mirrors (Clean not broken) NOTE : Trucks with bull bar bring down

CAB DRILL

- Heater / Demisters controls
- Hazard lights
- Fuel (Check enough for trip)
- Temp gauge.
- All warning lights
- Rev counter (Mention TURBO)
- **Torque range (When you get the most speed out of truck) is between 1300 to 2000.**

NOTE Anything over 2000 revs is just wasting fuel.

- Air pressure gauges
- Must be at least 8 bars. (When in red air buzzer will come on and small light will come on)
- Cab Lights
- Right hand mirror heater
- Diff lock (Only for sand /gravel) Never turn on bitumen with diff locked
- L/H Mirror control
- Right Door
- Window Lock
- Door lock
- Engine Idle (leave alone)

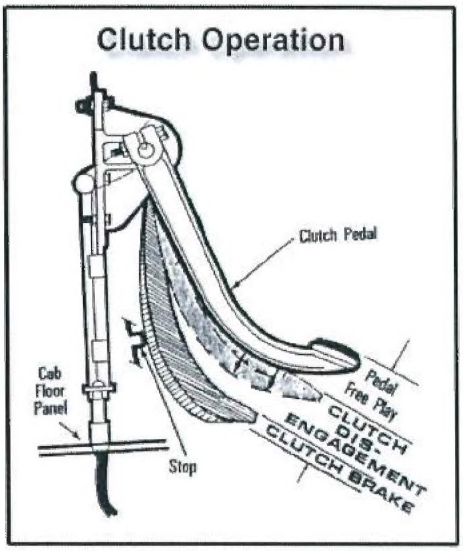
- Steering Wheel adjustment
- Ignition Key
- Black button push to remove key
- **Indicator Lever** - (Indicator lever can be pushed down and HIGH BEAM will come on.)

MAKE SURE HIGH BEAM IS NOT ON.

- Cruise control (don't use)
- Horn
- Fog lights /Driving lights
- Trailer brake (not in use)
- Exhaust brake on / off
- Explain Jak brake or (Engine Brake) in heavy trucks (Switch on dashboard)
- PARK BRAKE
- Adjust all mirrors

GEARS 13 SPEED

LIGHT HANDED DON'T FORCE AT ANY TIME



1.CLUTCH BRAKE (STOP CLUTCH)

2. When you depress the clutch, it will stop the gears from spinning, so you can select a gear.

3. If the gears are still spinning you can put light pressure on gears to stop them from turning.

4. The stop clutch (Clutch brake) is there to stop the gears from turning

- After you have held the clutch for approx 3-4 sec you should be able to select gears
- If gear lever will not go in, leave some pressure on gear lever and slowly bring clutch out, only to get the gears to turn. Gear should engage.

NOTE: IF NO SILVER BUTTON (Clutch brake) on gear lever, clutch brake will be at the end of the travel of the clutch.

When changing gears **only press half way.** When selecting forward (2nd) or reverse gear press **ALL THE WAY DOWN**

RANGE SELECTOR

CHECK THAT IS DOWN BEFORE MOVING OFF

NOTE :If you forget to push the selector down and start of in 6th gear **DON'T PANIC**

1. Just push the range selector down and select 3nd gear, as you would have started to move.

2. This is a good driving practice, and you have fixed the problem.

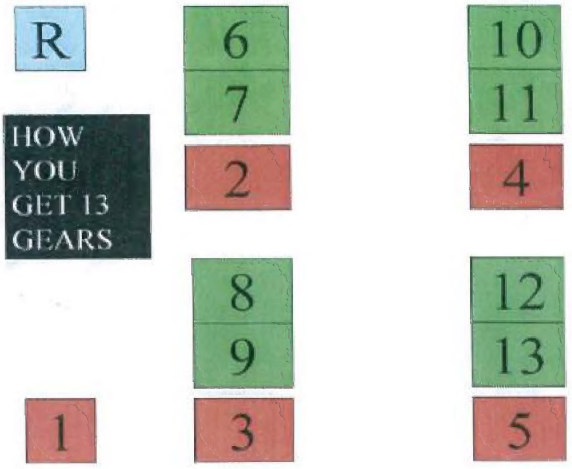
SPLITTER SELECTOR

Only for gears 5,6,7,8. (in these trucks

NOTE :Some other gear boxes you can split 1,2,3,4.

EXPLAIN 18 SPEED (SPLIT ALL)

- **With exhaust brake OFF PUSH RED BUTTON FORWARD, TOWARDS FRONT OF TRUCK, WHILE GEARS (OR ENGINE) ARE PULLING.**



TAKE FOOT OFF ACCELERATOR AND GEAR WILL GO INTO HIGH.

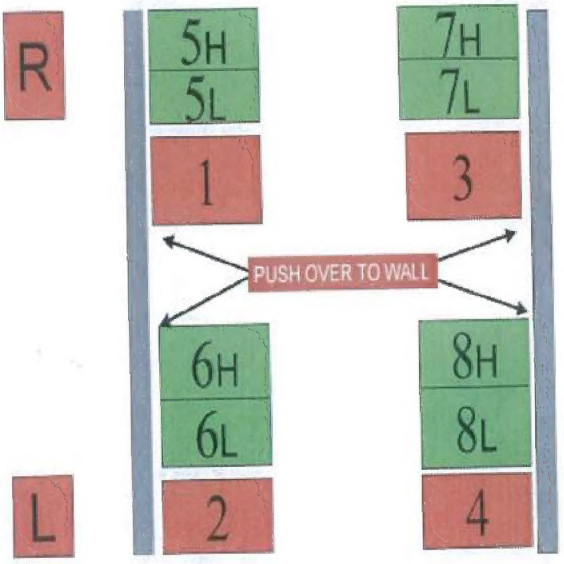
WHILE IN HIGH AND GEARS ARE PULLING, PUSH RED BUTTON BACK TOWARDS THE REAR OF THE TRUCK, THEN CHANGE GEAR UP - IT WILL SELECT LOW

THIS IS SO YOU CAN SELECT 1/2 A GEAR MAINLY USED FOR GOING UP HILLS

GEARS UP / DOWN

MUST NEVER FORCE GEARS

- Build revs up to 1500 and hold them
- Then jab the revs up to 1500
- Then look out side and jab up to 1500 revs - you need to hear the revs
- Build revs up to 2000 and hold them
- Then jab the revs up to 2000
- Then look outside and jab up to 2000 revs - you need to hear the revs



NOTE: IF YOU GO INTO THE RED A WARNING LIGHT WILL COME ON AND THEN THE BUZZER

- Select 2nd gear (1st gear is too low)
- Release park brake
- Clutch out to friction point
- Build revs up to 1500
- Double clutch into 3rd

NOTE: IF YOU MISS THE GEAR, PUT GEAR LEVER BACK INTO NEUTRAL, BUILD UP REVS AND TRY 3rd GEAR AGAIN.

Select 4th THEN LIFT RANGE SELECTOR READY FOR 5th GEAR

(PRESELECT)

When selecting 5th put pressure on gear lever into neutral then over to L/H wall of gearbox.

Select 6th gear by sliding gear lever along wall pressure pushing back and to L/H side of truck
Select 7th by coming over to the R/H wall

Select 8th by sliding lever along R/H wall back and to R/H side of truck.

STOP TRUCK
PRACTICE GOING UP GEARS UNTIL TRAINEE IS CONFIDENT AND SMOOTH
NOTE: DON'T DROP THE CLUTCH BECAUSE CAB WILL BOUNCE AND TRAINER NOT HAPPY

EXERCISE TO SHOW REVS TO ROAD SPEED

SELECT 2nd GEAR AT 1500 REVS → LOOK AT ROAD SPEED
3rd →
4th →
5th →

5th GEAR at Idle. Look at the flexibility of 5th gear. This is your gear from GOD

SELECT 6th GEAR AT 1500 REVS → LOOK AT ROAD SPEED
7th →
8th →

NOTE	SHOW EXHAUST BRAKE USE AS REQUIRED

GEARS DOWN

YOU MUST BRAKE DOWN TO THE ROAD SPEED OF THE GEAR YOU WISH TO CHANGE DOWN TO.

EXAMPLE

1. 8th to 7th = Brake down to a 7th gear road speed
2. 8th to 4th = Brake down to a 4th gear road speed

DOWN GEARS

EXAMPLE - 1. 6TH TO 5TH

- brake first
- Clutch in - gear lever to neutral
- Leave L/H ON gear lever
- Build up revs by jabbing up to about 1800 revs

NOTE WHILE REVS ARE COMING DOWN, FEEL THE GEAR IN - DON'T FORCE.

If it doesn't go in try again

IF YOU BRAKE DOWN TO A 5th GEAR ROAD SPEED AND YOU MISSED THE GEAR, WATCH YOUR ROAD SPEED BECAUSE IF YOU LOSE YOUR ROAD SPEED, YOU DON'T NEED A LOT OF REVS.

IF YOU ARE GOING UP HILL, THE HILL WILL SLOW THE TRUCK OR EVEN STOP IT

SYSTEM OF VEHICLE CONTROL (svc)

NOTE:

ONCE YOU HAVE MASTERED GEARS UP AND DOWN IT IS TIME TO LEARN CORNERING

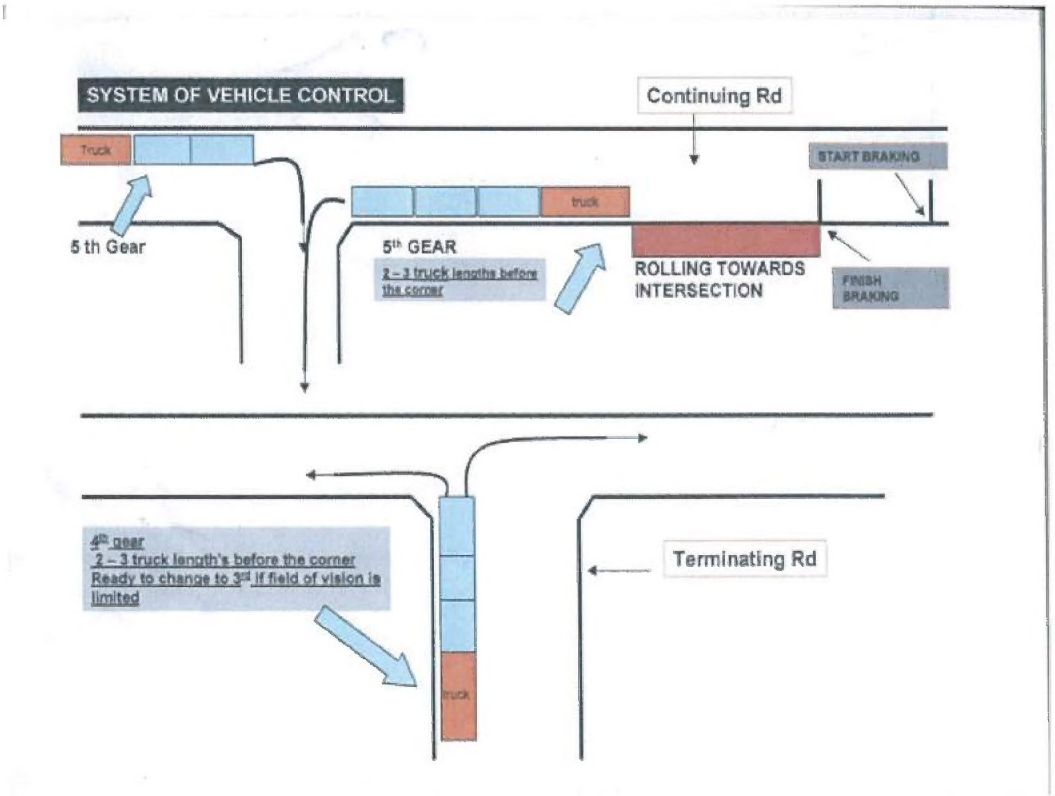
SYSTEM OF VEHICLE CONTROL

BEWARE OF THE ROLL PERIOD WHEN YOU ARE A NOVICE

CONTINUING RD INTO A TERMINATING 5th GEAR

TERMINATING INTO A CONTINUING 4th GEAR READY TO GO INTO 3rd IF THE FIELD OF VISION IS LIMITED.

FREEZE CHANGE When steering wheel is in a frozen position (NOT MOVING) you can change a gear. If it is a wide intersection you can change 2 or 3 gears as long as the steering wheel is not turning.



HILLS DRIVE

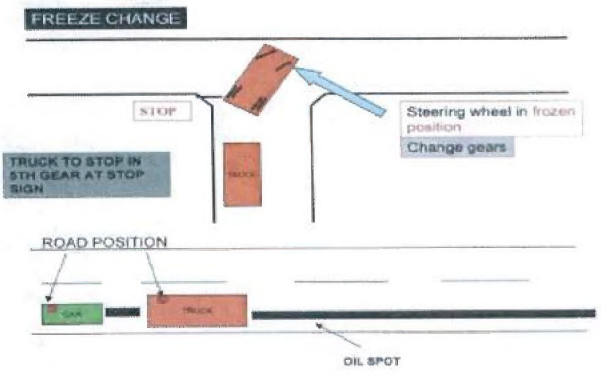
NOTE:	KEEP ROAD SPEED AND REVS UP LISTEN TO REVS YOU MAY NEED TO HOLD THE REVS AT 1800 OR 2000 CHANGE BEFORE 1500 REVS BEFORE THE TRUCK STARTS TO LABOUR
EXERCISE :	Select 1st gear and go down hill Gear is holding truck back with exhaust brake ON Select 4th gear with exhaust brake ON Holds back but moving fast Select 4th with exhaust brake OFF RESULT = RUNAWAY
SKIPPING GEARS	Talk about skipping gears when coming down hill Look at the grade of the hill and choose the gear you feel the truck can manage.
HOW TO WORK OUT HOW STEP A HILL IS	Look at the valley in the distance Top of power poles Top of houses
DRIVING COACHES	Watch out the front of the coach doesn't dig into the road Watch the rear of the coach doesn't get dragged on the road FRONT AND REAR OVER HANG
CHANGING GEARS GOING UP HILL	When changing gears up, going up a hill you will need to build your revs up to 2200 or you will loose your revs and road speed
DOWN HILL	When driving down hill hold truck in gear that you feel safe and the truck is not running away. NOTE : the general rule is what ever gear you go up the hill (Loaded) you come down the hill loaded. Depending on the load.

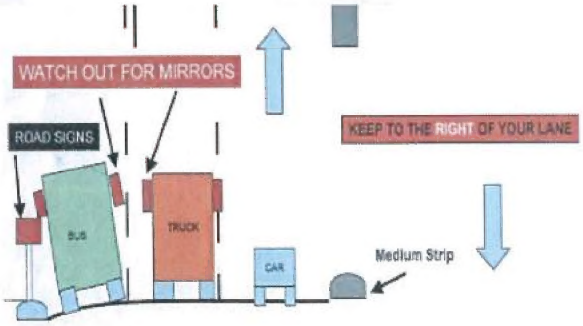
LIGHT TRAFFIC / CORNERING

YOU MUST BRAKE TO THE SPEED OF THE GEAR YOU WANT TO SELECT. IF YOU MISS THE GEAR TRY REVVING THE ENGINE MORE

IF YOU FEEL YOU ARE GOING TOO FAST - WITH CLUTCH OUT

If you brake to a 5th gear road speed and you miss the gear SEVERAL TIMES. THE TRUCK WILL BE SLOWING DOWN SO YOU WILL NOT NEED SO MANY REVS.





CITY DRIVE

Keep to the right of your lane or you will lose your mirrors
Watch for opening doors

Buses indicating out have the right of way

Vehicles wheels turning to the right when vehicle parked

Go with the flow of traffic read the road ahead.
You are up high with good visibility

- Pedestrians
- Read traffic lights
- Push-bike couriers
- Taxis

Watch for EMERGENCY VEHICLES

NOTE:

LOOK OUT FOR KANGAROOS AT BARRACK ST AND ST GEORGES TCE.

PULLING INTO KERB When pulling into kerb use something on the dash or front window as a guide and check L/H mirror. About 5" to 9" away from the kerb.

RAILWAY CROSSINGS

Approach with caution

Look both ways

Be in a pulling gear

Don't change a gear on a railway line

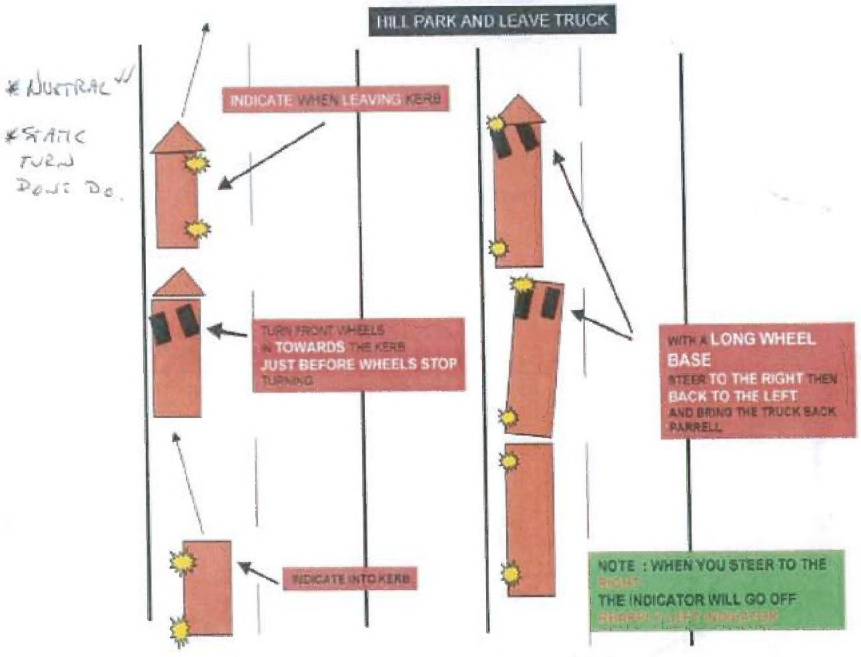
HILL PARK / LEAVE TRUCK

Always indicate left into the kerb

Before the wheels come to a stop bring the front wheels in towards the kerb, so the truck will run off the carriageway if the brake fails.

Gear in neutral and handbrake on

If you have a long truck you may need to steer the vehicle to the right approx two half turns to the right, then re-apply the indicator, then steer four turns to the left to bring the truck back parallel and the wheels are in towards the kerb



FOR TRUCKS THAT CAN BE PARKED IN GEAR

Up hill park in first gear

Down hill Reverse gear

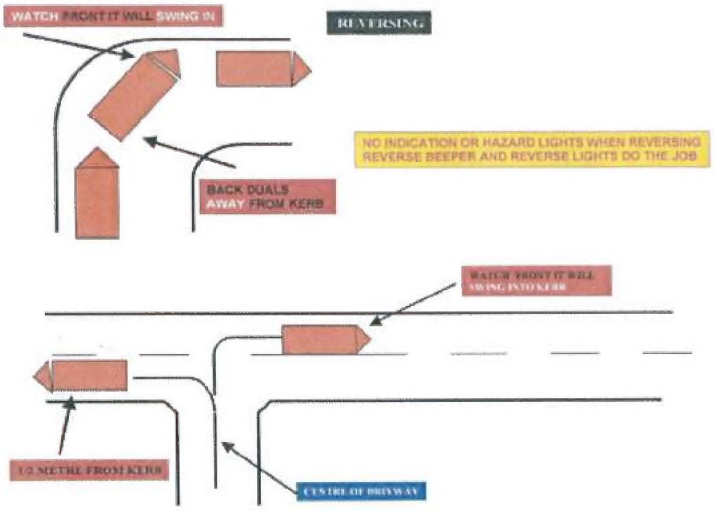
REVERSING

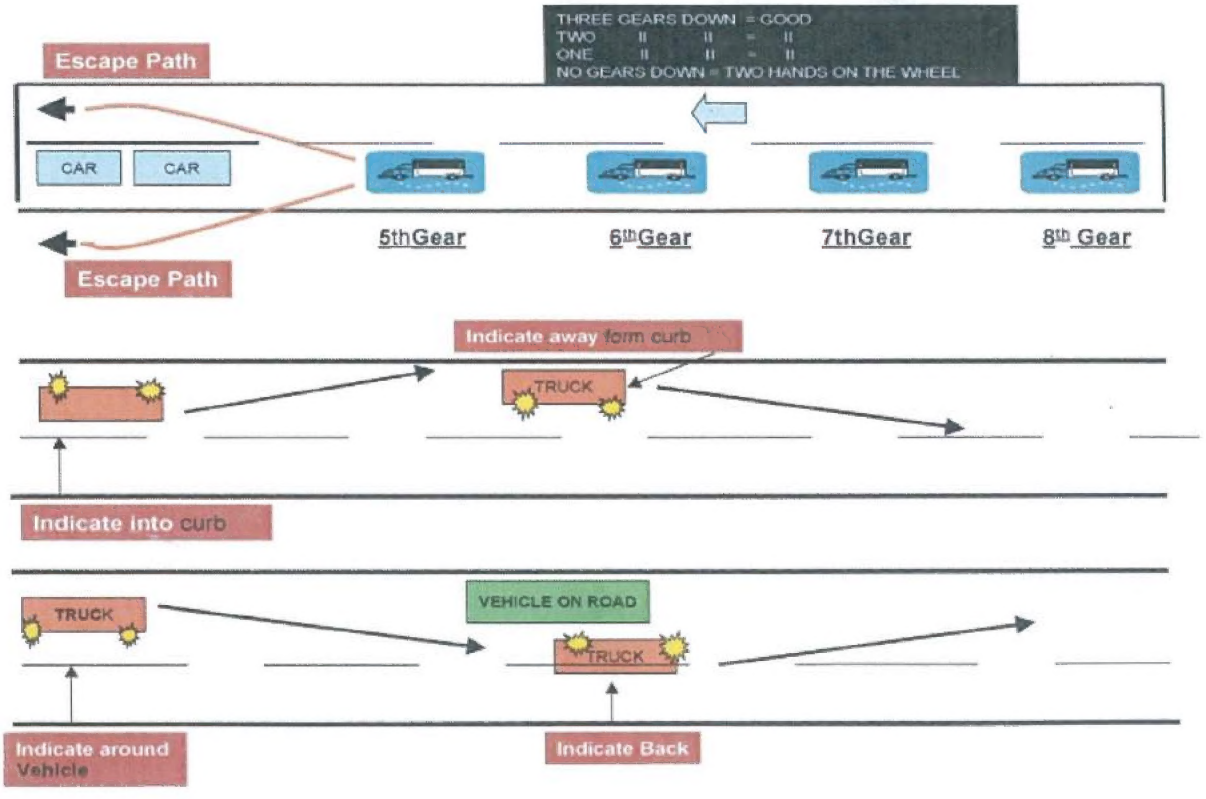
Select the gear

Check mirrors

Always indicate when pulling up to stop and reverse

Always indicate when pulling away from the kerb





HEAVY VEHICLE MECHANICS

BRAKING

As a professional driver of a HR vehicle, you should be aware of the danger posed by your vehicle should you lose control of its speed or direction. The following braking rules must be applied at all times while driving HR Vehicles:

- brake early and gradually
- brake in a straight line
- allow for the load
- match your braking to the road surface
- ease off as the vehicle slows
- test your brakes after driving through water.

Many of the latest HR Vehicles are fitted with anti-lock braking systems (ABS), which are designed to prevent wheel lock up and improve manoeuvrability under braking. Maximum braking occurs when the wheels are just on the point of locking, but if a wheel locks and skids, braking effectiveness is reduced.

Heavy vehicles will be more difficult to stop under braking, depending on their size and their load. Road and weather conditions affect braking performance. The speed of vehicles will also affect braking performance, as will the time taken by drivers to react to the need for braking. You must consider all these factors when driving, especially as the loss of vehicle control (skidding) is both dangerous and frequent. For example, the heavier the vehicle, the wetter the road, the faster the speed, the more tired the driver and the harder the braking, the more likely skidding will occur.

Downhill speed should be controlled by use of engine speed and correct gear selection. If braking is necessary during a descent, a driver should, if possible, try to brake only when the vehicle is travelling in a straight line. Braking on a bend increases the risk of skidding and should usually only be used in an emergency. If braking must be applied on a bend, it should be done as gently as possible.

As a professional HR driver you should always be aware of the potential danger of your vehicle.
Your complete understanding of the braking system of your vehicle and skill in using it correctly are essential to your safety and that of the general public. Never drive a vehicle if you are not familiar with its braking system.

There are three types of braking systems found on heavy vehicles they are

[A] Hydraulically activated

[B] Air over hydraulic,

[C] Full Air

The hydraulic system uses fluid pressure to activate the system ie You place your foot on the brake pedal which opens a valve at the master cylinder forcing the fluid to travel along the brake lines as this is a sealed system. The fluid compresses creating a pressurised force at the wheel cylinder which then converts that pressure into mechanical energy by forcing two pistons to travel out wards which in turn forces the brake pads to make contact with the braking friction point.

Air over hydraulic this system works on a combination off air and fluid pressure. When you apply your foot brake air pressure is applied to your system as far as an air ram piston, the ram is connected to an master cylinder so at this point the the air pressure is converted into fluid pressure, the fluid pressure is then converted into mechanical energy at the wheel cylinder.

Full air system this system works purely on air pressure and is the main system that we will cover. Some of the main components of an air brake system are

- **Air compressor**

The air compressor is a piston driven pump which is driven off the engine.
supplies air for your braking system. This is the power for the braking system.

- **Air governor**

The air governor controls the compressor. When the compressor is either cycling or unloading it is designed to maintain or regulate constant air pressure between 100 to 120 psi

- **Air dryer**

The air dryer is designed to extract moisture and any oil from within the brake system. This is achieved through the use of a desiccant material which traps the oil and moisture as the air flows through the dryer

- **Air tanks**

The air tanks are where the air is stored for the braking system it consists of

a) Wet tank,
Where any oil or moisture that got through the air drier is trapped.

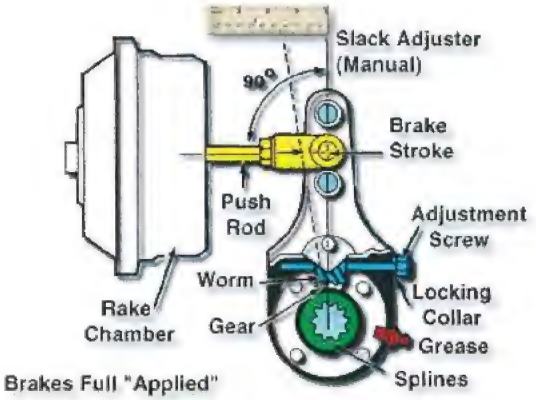
b) Primary tank
This tank stores air for the primary system.

c) Secondary tank.
This tank stores air for the secondary system.

- **Supply lines.**
These are what connect all of the different parts of the system together. The system is controlled by a series of valves

The dual control foot valve
This is a twin system that is activated by the foot pedal. It uses both the primary air and the secondary air systems. The primary air is used to apply the rear brakes and the secondary system is used for the front brakes. This is done in case one of the air systems fails and this leaves you with some braking capability still available.

Relay valve
The relay valves are used on the rear axles of the vehicle. They are designed to minimise brake delay to the rear axles. They are supplied with unmodulated air, which enables them to charge the system very quickly when the foot brake is applied.



Brakes Full "Applied"

Two way check valves
These monitor the air pressure flow from both the primary and secondary air systems and allow the dominate air pressure to flow through the system.

One way valve
These allow the air to travel in one direction only. they are located between the air tanks to help maintain air integrity if a tank was to rupture.

Safety blow of valves
These are designed to allow air to discharge from the system if the pressure becomes to great. Tractor protection valve On a rigid Vehicle this is incorporated into your emergency air system it allows you to move your vehicle a short distance if you loose air

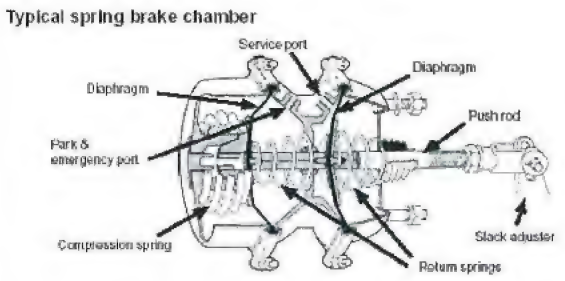
The service brake
This is the mechanical component

Brake actuator (Brake chamber).
The brake chamber or actuator is where the air pressure is converted into mechanical force. There are two different types of chambers used.

Single spring type

These are found primarily on the front axles in Australia. They work on direct air pressure when there is no air pressure the spring is released which in tum releases the brake. This is a safety feature if the vehicle was to loose air pressure the vehicle could still be steered allowing you to be able to steer the vehicle.

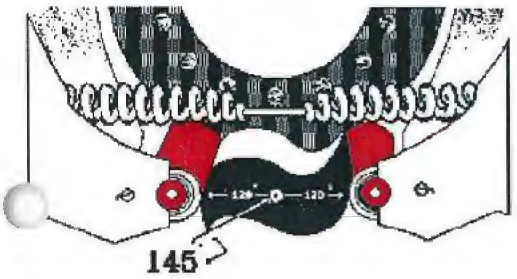
Dual spring type [Maxi brake]



Fitted to the rear axle these have two chambers. The first chamber works the same as the single type. The second chamber works in reverse. If the air pressure drops the brake is automatically applied overriding the first chamber as it has a heavier spring. This is a safety feature if the air integrity is compromised.

Slack adjuster

The slack adjuster is used for fine brake adjustments on the vehicle. It allows you to achieve brake balance to minimise brake fade. The slack adjuster is connected to the actuator via a push rod.



Drum brake

The drum brake is the most common type found on heavy vehicles. This is operated by means of an s cam, which is connected to the slack adjuster via a spline that rotates forcing the brake pads onto the friction surface of the drum.

BRAKE CHECK

1. Build up air pressure
2. Apply handbrake. Try to move forward. Vehicle should not move
3. Release handbrake, move vehicle forward for 2 metres and apply foot brake.
4. Vehicle should stop.
5. Leave foot on brake and listen for air leaks.

Brake balance brake balance is the amount of pressure applied by each individual brake to its friction surface. If all of your brakes have the right amount of adjustment the workload is distributed proportionately throughout the system. If you had your brakes at different adjustments the brake with the most adjustment would apply the most pressure causing it to take most of the workload. This will then cause the brake to overheat which in tum would reduce its capability transferring the work load to the next one and so on and so on.

To check the balance of your brakes follow these steps

1. Chock vehicle from forward and rearward movement.
2. Build up air pressure until blow of valve operates.
3. Turn vehicle off.
4. Release all brakes
5. Climb under the vehicle and pull on the slack adjuster it should move no more than an inch / 2.5cm

Repeat step 5 for the rest of your brakes. Whilst under the vehicle you should also check for any air

Snub Braking

In recent years there has been some erroneous information going around about how to brake on long downhills. It was suggested not too long ago that a continuous application of the brakes as opposed to intermittent application or snubbing was the preferred method. *THIS IDEA IS COMPLETELY WRONG!*

The proponents of the old theory have rescinded it, there is now (almost) universal agreement that the proper way to brake on a downgrade is to intermittently apply all your service brakes in a way that will reduce the speed of a fully loaded vehicle by about 8 or 10 kph during each application. What is key here is not the speed drop, this will depend on weight, grade and other factors, but air pressure, **you have got to get the application pressure high enough to get all your brakes working.**

In theory, it doesn't make any difference whether you ride or snub the brakes on the way down. The problem is that you don't drive a theory, you drive a truck. In theory, the same amount of heat is put into the braking system regardless of how you apply the brakes. In practice, unless your brakes are in good condition, truck balance is right and the load is ideally located, the continuous application of the brakes is

likely to result in uneven drum and lining temperatures and problems before you get to the bottom of the hill.

Steady, low pressure application of the brakes may not cause all the brakes on the vehicle to apply and may result in some brakes -those with the lower activation pressures- doing more work than others. Specifically, in many cases the truck brakes will do too much of the work while the trailer brakes loaf and you might then get fade at the tractor axles.. Other brake problems can be aggravated by the low and steady braking technique. **What you want is all the brakes working some of the time, not some of the brakes working all the time. The application pressure must be high enough to ensure that all brake chambers apply and that all linings make solid contact with the drums - about 20 psi or higher.** Braking, or deceleration, is the opposite of acceleration. Both take place over time and require distance. This is not instantaneous. **The optimum stopping distance required will be about 4 times longer as the speed doubles.**

THRESHOLD BRAKING

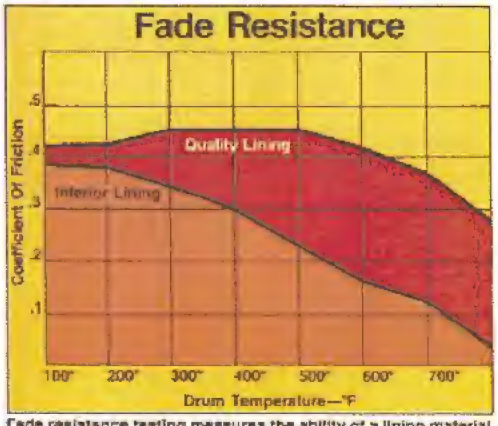
The threshold to braking is where the tire is at its **maximum ability to brake**, just before wheel lock. If you lock up the rear tires, the back end will come around and the vehicle will spin on its axis. If the front wheels lock up the vehicle will not turn and you'll loose directional control.
Threshold braking is **a finesse procedure.** It is not always applicable, but knowing the technique serves as a benchmark for distance required to brake. Your braking capability will give you a good parameter for speed judgment. Braking in traffic should include the ability to threshold brake and the awareness that people and conditions may alter the braking application.
Threshold braking is the **best** way to stop and it will give you a good reference from which to determine all stops. The distance required will vary for different vehicles and even for the same vehicle under changing conditions. But it will be consistent within the same vehicle under similar conditions.

Chain reaction accidents, where the trailing vehicles pile into the back of the leading vehicles in succession, happen when the collective braking process does **not** have enough time to occur. This stacking effect can be avoided by including as many vehicles as possible in your field of vision.

If you notice that the vehicle three or four vehicles in front of you has his brake lights on, start braking gently. This will prevent you from stacking, as each vehicle will need to brake sooner to avoid the chain reaction. **Early braking** will also alert trailing vehicles to the danger and afford you some control over the sequence of events.
The ability to stop plays a major role in the ability to go fast and, as a result, changes your perspective on the safe application of speed. It takes about **1 second to switch from gas pedal to brake pedal** once your mind determines there is reason to brake. During this time, your vehicle has continued at the previous rate of speed. Threshold braking optimises stopping distance. If you lock the wheels, the vehicle will require 30 percent more stopping distance.

Brake Fade

Brake fade is caused through overheating due to poor brake balance or riding of your brakes. Brake fade is caused by gas trapped between your pads and the friction surface. As heat builds up the dirt and glues used to bond the pad start to form gases. Under normal application these gases are vented but when the heat becomes excessive there is to much gas to vent .The trapped gas doesn't allow your pads and friction area to make full contact causing loss of braking. In extreme cases this can ignite any oil grease etc inside the brake area to catch fire. If this happens it is a very dangerous situation .The best way to put one of these out is sand don't use water as it can cause the friction surfaces to explode.



Fade resistance testing measures the ability of a lining material to maintain coefficient of friction with increasing temperature.

DIFF LOCK

A diff lock locks the differential drive axles together causing both wheels to turn no matter which wheel has traction.

POWER DIVIDER LOCK

The power divider supplies power from one axle set to another and incorporates its own inter axle differential unit. **The Power Divider Lock** works similar to the diff lock except it supplies equal power to both axle sets even if one set loses traction.

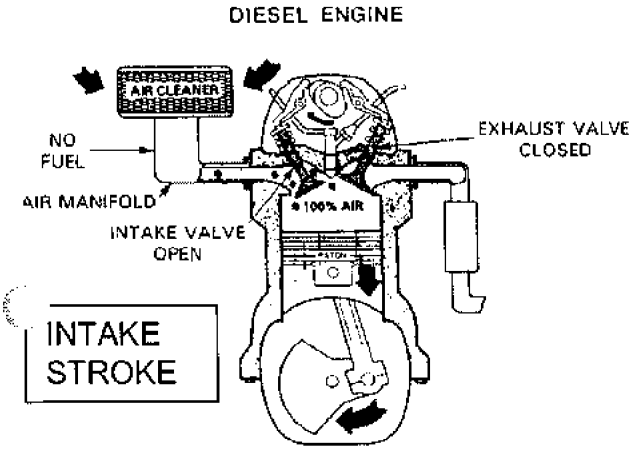
REMEMBER THIS!

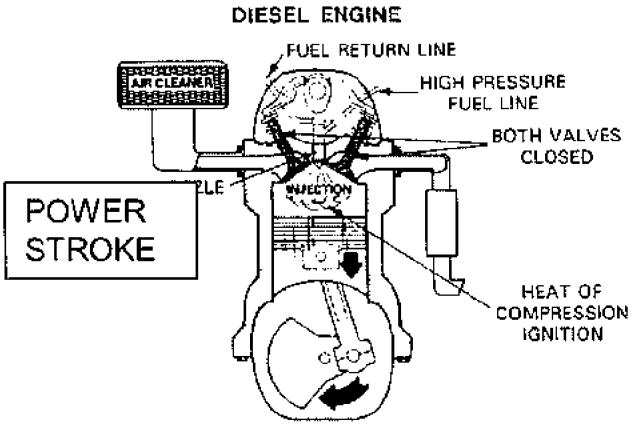
WHEN YOU ARE ON A LOOSE TRACTION SURFACE, THE SWITCH IS "IN".
WHEN YOU ARE ON A FIRM TRACTION SURFACE, THE SWITCH IS "OUT
The power divider lockout is never to be shifted while the truck is in motion. When you encounter abnormal road conditions, and need to use the lockout, you should follow this procedure.

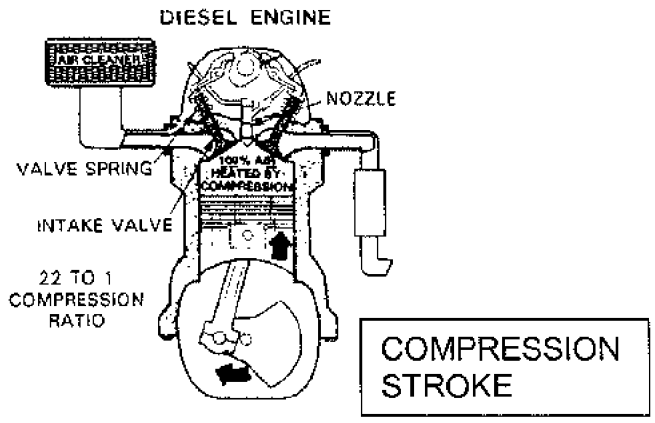
1. First, **stop** your truck completely.
2. Place the transmission in neutral.
3. Switch the power divider in
4. Place the transmission in low gear
5. Slowly re-engage the clutch
6. When **disengaging** the lockout, the same method applies – **stop** the truck completely
7. Put the transmission in neutral
8. Switch the power divider out
9. Place the transmission in low gear
10. Slowly re-engage the clutch and drive away

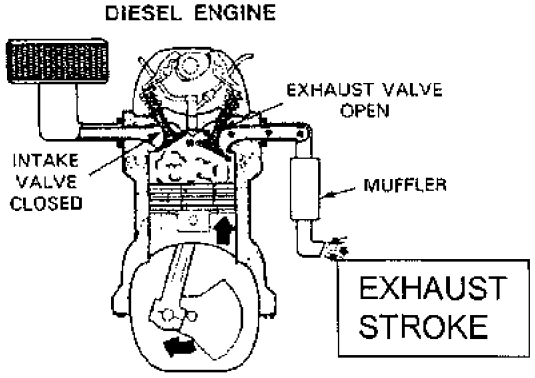
DIESEL ENGINE

A DIESEL ENGINE IS A COMPRESSION IGNITION ENGINE. It compresses air until the air is hot enough to ignite the fuel. A spark plug would not ignite diesel fuel properly. If petrol were used in a diesel engine, it would detonate on the compression stroke and not produce useful energy. Since diesel fuel is thick and hard to ignite, a high-pressure mechanical pump and nozzles force the fuel into the engine combustion chambers. An extremely high compression ratio heats the air in the cylinder. Then, when fuel is sprayed into the hot air, it begins to burn.









Intake

The piston moves from the top of the cylinder to the bottom. Air is pulled in through an open intake valve.

Compression
The piston moves up compressing and heating the air trapped in the cylinder.

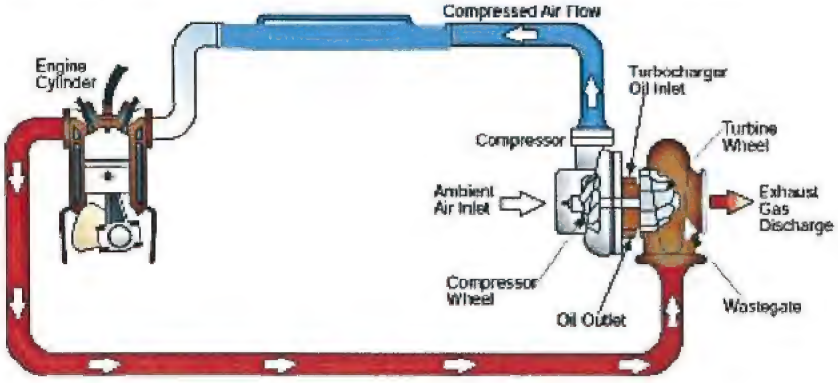
Power
Fuel is injected into the heated air causing combustion, which pushes the piston down.

Exhaust
The piston moves up pushing burned gases out of the cylinder through an open exhaust valve.

Turbo charger

Turbo charges are a type of forced induction system. They compress the air flowing into the engine. The advantage of compressing the air is that it lets the engine squeeze more air into each cylinder. More air means that more fuel can be added, therefore you get more power .A turbo engine produces more power overall than a non turbo engine .The advantage of this is that you increase the power to weight ratio without having to increase the engine size.

To achieve this boost of power the turbo uses the exhaust gases to drive a turbine which in tum spins an airpump .The turbine inside the housing can spin up to about 150,000 rpm. Due to the fact that the turbo is driven off the exhaust the temperature inside the turbine is extremely high. So the vehicle must be allowed to idle before shutdown to let the temperatures drop and the heat to be dissipated over a greater area again helping to lower temperature.



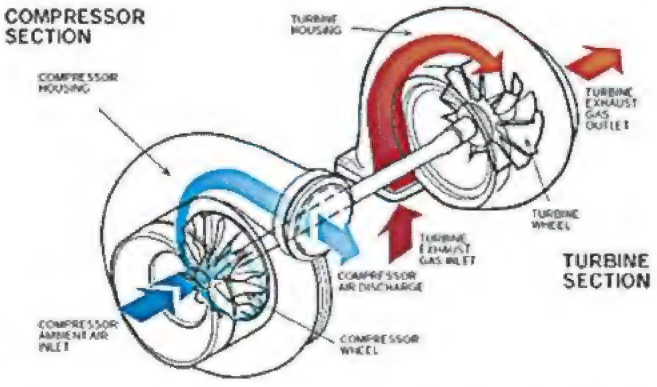
How it works

The turbo is bolted into the exhaust manifold the exhaust spins the turbine the turbine is connected to the compressor by a shaft .The compressor is located between the air filter and the intake manifold. The compressor pressurises the air going into the cylinder.

Turbo lag

Turbo lag is the time it takes for the turbo to get up sufficient speed to apply enough compressed air to give you boost.

The waste gate allows exhaust to bypass the turbo if too much pressure is built up in the engine compression cylinder thereby minimising any damage to the system. These are common on vehicles that have sequential turbos.



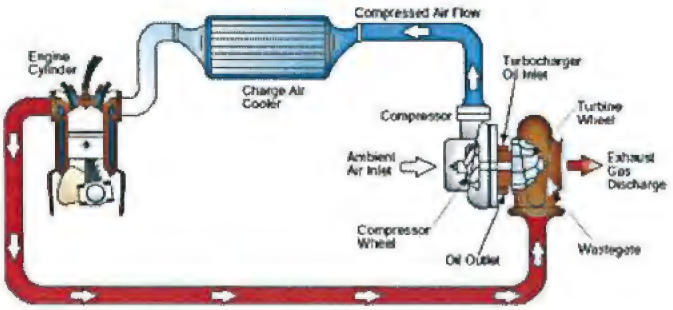
Sequential turbochargers.

Some engines use two turbos of different sizes. The smaller one spins very fast to reduce lag time then the larger one takes over at higher rpm. This is the reason for the waste gate.

It will stop the smaller turbo from spinning too fast. The faster it spins, the pressure is created in the engine cyclinder

Intercooler

When air is compressed it heats up and when it heats up it expands so some of the pressure increase from the turbo is hot air .To get better performance you need to try and cool the air - this is the job of the intercooler .Why cool the air? The cooler the air the more dense the air becomes resulting in more molecules entering the cylinder compression chamber, giving you a greater detonation and therefore producing more power,



The intercooler is an additional component. It looks similar to a radiator and is located between the turbo and the intake manifold. It works from air passing inside it and flowing over cooling fins located on the outside. By including an intercooler into your system you increase your power again.

Super charger.

The super charger does basically the same job as a turbocharger. The main difference between the two is that a super charger works constantly and is driven by either gears, belt or chain.

The super charger will normally operate at the same rpm as the engine or double the rpm.

Both systems supply about 6-8i of boost.

What is torque?

Torque is a *force that tends to rotate or turn things.* You generate a torque any time you apply a force using a wrench. Tightening the lug nuts on your wheels is a good example. When you use a wrench, you apply a force to the handle. This force creates a torque on the lug nut, which tends to turn the lug nut

A car engine creates torque and uses it to spin the crankshaft. This torque is created exactly the same way: A force is applied at a distance. Let's take a close look at some of the engine parts

The combustion of gas in the cylinder creates pressure against the piston. That pressure creates a force on the piston, which pushes it down. The force is transmitted from the piston to the connecting rod, and from the connecting rod into the crankshaft. The point where the connecting rod attaches to the crank shaft is some distance from the center of the shaft. The horizontal distance changes as the crankshaft spins, so the torque also changes, since **torque** equals **force** multiplied by **distance**.

What is Power?

Power is a measure of how quickly work can be done. Using a lever, you may be able to generate 200 ft-lb of torque. But could you spin that lever 3,000 times per minute? That is exactly what your car engine does.

Common Units of Power
SI:
Watts (W)
1000 W = 1 kW
Kilowatt (kW)
1 kW = 1.341 hp
English
Horsepower (hp)
1 hp = 0.746 kW

The SI unit for power is the **watt**. A watt breaks down into other units that we have already talked about. One watt is equal to 1 Newton-meter per second (Nm/s). You can multiply the amount of torque in Newton-meters by the rotational speed in order to find the power in watts. Another way to look at power is as a unit of speed (m/s) combined with a unit of force (N). If you were pushing on something with a force of 1 N, and it moved at a speed of 1 m/s, your power output would be 1 watt.

An interesting way to figure out how much power you can output is to see how quickly you can run up a flight of stairs.

1. Measure the height of a set of stairs that takes you up about three stories.
2. Time yourself while you run up the stairs as quickly as possible.
3. Divide the height of the stairs by the time it took you to ascend them. This will give you your speed.

For instance, if it took you 15 seconds to run up 10 meters, then your speed was 0.66 m/s (only your speed in the vertical direction is important). Now you need to figure out how much force you exerted over those 10 meters, and since the only thing you hauled up the stairs was yourself, this force is equal to your weight. To get the amount of power you output, multiply your weight by your speed.

Power (W) = (height of stairs (m) / Time to climb (s)) * weight (N)
Power (hp) = [(height of stairs (ft) / Time to climb (s)) * weight (lb)] / 550

Horsepower

What else affects our horsepower?

- The size of the piston – the bigger the piston, the more power because we can compress more air into the combustion chamber
- Electronic engine management system – computer controlled air fuel mixture to maximise efficiency and power at varying rpms
- Injector pump – Supplies the fuel under pressure to the injector. The higher the pressure, the more fuel is delivered
- Injector nozzle – the size of the nozzle regulates the amount of fuel entering the combustion chamber
- Turbocharger – boosts the air supply within the induction system
- Intercooler – the more efficient the cooling process for the air induction, the denser the air creating more air molecules.

GEARBOX & CLUTCH

PROGRESSIVE SHIFTING & TORQUE

Progressive shifting is a technique in which you shift like an automatic transmission, that is, you gradually increase speed and rpm's. There is no need to accelerate to governor, just to toque roll in. Torque roll in is basically when a gear gives you its maximum torque. You must shift to the next gear.

Progressive shifting reduces equipment wear and saves fuel.

Rpm's will be different with progressive shifting. Are you empty or loaded? Are you going uphill or downhill? What terrain are you driving in? All of these will affect rpm's.

Selecting and Changing Gears

The ability of a vehicle to perform its tasks is based on the efficiency of its engine. When engines burn fuel, energy is released, but this cannot be used effectively unless the engine's power is managed properly. The driver is responsible for this management, by recognising and using the engine's ability as defined by its manufacturer.

Drivers of any rigid vehicles must select an appropriate gear, according to the engine speed required to complete the demands placed on the vehicle. There is a limited range of engine speeds (RPM) which produce high torque (force) and good fuel economy. Gears are designed to achieve the best engine speed that improves the use of fuel and reduces wear on the engine.

Manufacturers specify the engine RPM range for maximum torque. When accelerating or climbing a hill, you should usually up-shift or down-shift whenever the engine is approaching the limit of the RPM range.

On a relatively flat road, where maximum pulling power is not critically important, you should select the gear which enables the engine to run at its most economical speed. This engine speed may be specified by the manufacturer, and may be slightly above the range specified for maximum torque. Experienced drivers may use the sound and feel (i.e. vibrations) of the engine as guides to gear shifting.

Warning - never coast any vehicle

Never under any circumstances allow a vehicle to coast, either in neutral or in gear with the clutch disengaged.

This extremely dangerous practice can easily lead to complete loss of vehicle control and has been the cause of numerous serious accidents and loss of life.

The following are just some of the risks associated with coasting.

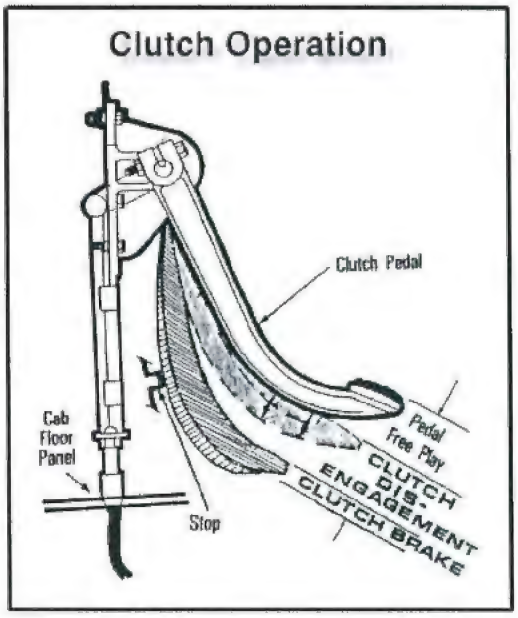
These are:

- If the vehicle speed becomes too great and the brakes are used during a descent, they may overheat and fail.

- It may not be possible to re-engage a gear when needed, especially if vehicle speed has increased beyond engine revolutions limits.
- Engaging the clutch while coasting may bum out or otherwise damage the clutch. You may also damage the transmission, over-speed the engine or skid the drive wheels.
- With the engine only idling during coasting, the air compressor may not be able to maintain air brake pressure, leading to failure of the brakes.
- If the engine should stall while coasting, it may be impossible to engage any gear. And the brakes may become ineffective or completely fail due to loss of air pressure or vacuum assistance by the engine.

Coasting is extremely dangerous, don't do it.

Vehicles should be able to be driven one million kilometres before any major work is need to be performed on them (ie. transmission,



Major cause of clutch failure is the misuse of equipment. Although you may not feel like this will affect you directly, think of cuts that may be necessary to fix equipment (ie. Less work, no bonuses, lack of equipment).

It is important to learn about shifting procedures, clutches, and how different transmissions work so that the life of equipment can be extended.

The clutch is what separates the engine from the rest of the drive train.

The clutch is divided into three parts:

1. The first 2-4cms of clutch movement is called **free play**.

2. From 4 – 7cms, you have **clutch disengagement**.

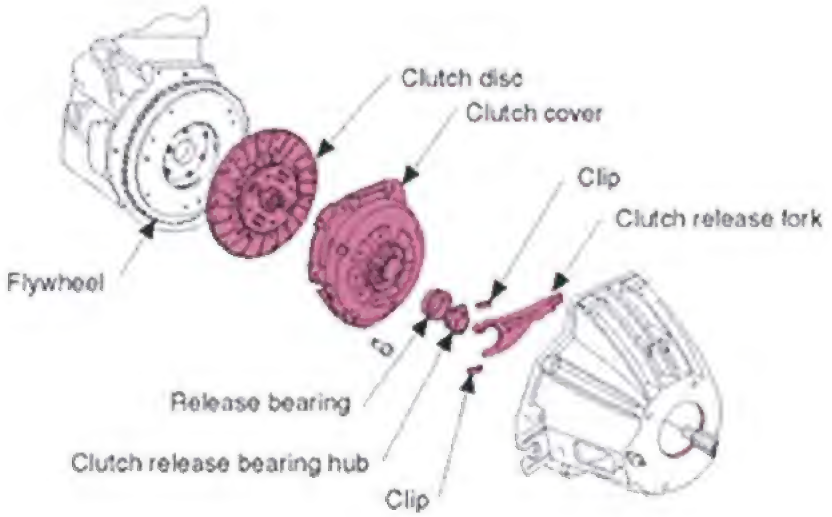
3. And when you have the clutch all the way to the floor, it is the **clutch brake**.

Do not get confused. Remember, when the clutch is in, it is disengaged.

When the clutch is out, it is engaged.

When you start an engine, the clutch needs to be all the way to the floor for two reasons: (1) safety and (2) to completely separate the engine from the rest drive train.

Speed shifting is when the clutch is used only to start and stop and in between gears you are not even touching the clutch. Speed shifting destroys transmissions. Floating gears is also unacceptable.



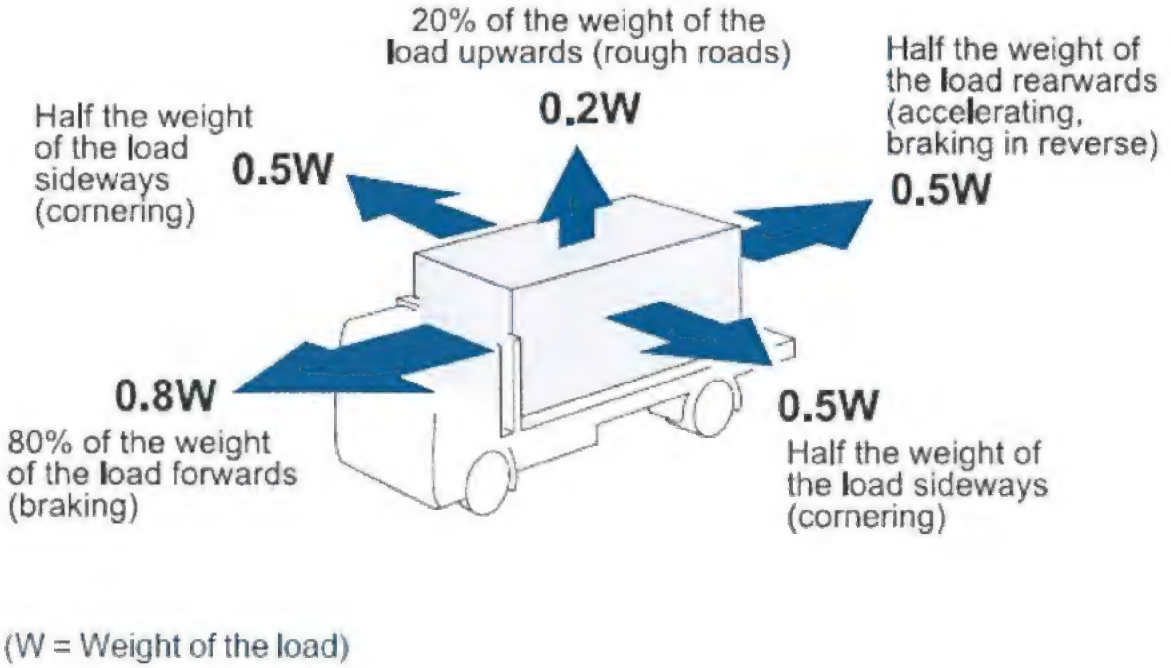
LOAD RESTRAINTS

Safe Working Load (SWL) sometimes stated as the **Normal Working Load (NWL)** is the mass or force that a piece of lifting equipment, lifting device or accessory can safely use to lift, suspend, or lower a mass without fear of breaking. Usually marked on the equipment by the manufacturer and is often 1/5 of the **Minimum Breaking Strength (MBS)** although other fractions may be used such as 1/4, 1/6 and 1/10.[1][2][3]

Other synonyms include **Working Load Limit (WLL)**, which is the maximum working load designed by the manufacturer. This load represents a force that is much less than that required to make the lifting equipment fail or yield, also known as the **Minimum Breaking Load (MBL)**. **SWL** or **WLL** are calculated by dividing **MBL** by a safety factor (**SF**). An example of this would be a chain that has a **MBL** of 2000 lbf (8.89 kN) would have a **SWL** or **WLL** of 400 lbf (1.78 kN) if a safety factor of 5 (5:1, 5 to 1, or 1/5) is used.

As such:

WLL = MBL / SF



(W = Weight of the load)

Why do you need loading regulations?

The loading regulations are the laws, rules and codes that tell you how to make sure that your load is safe. The regulations are carefully worked out making sure that the vehicle can be driven safely.
It is impossible to drive safely, or to keep a load on the vehicle if:

- the load is too heavy for the vehicle
- the vehicle is not suited to the load
- the load is stacked too high
- the load moves around when you brake or comer.

Why do loads move?

The regulations and codes covering loading and unloading of transport vehicles are designed firstly with your safety in mind. The regulations cover:

- dimension and weight regulations
- loading safety requirements
- special requirements for loads exceeding normal limits.

If your load is safely stacked and tied down it does not move, fall or spill.

If your load is safe:
- you are safe from injury
- the public is safe from injury
- the load is safe from damage
- the load cannot damage buildings or equipment
- the load will arrive safely at its destination.

Common sense tells you that when you are stacking a load, the heaviest items should go at the bottom.

The regulations tell you the weight limits and give you more detail about the safest way to load vehicles so that no-one is injured and the load arrives in good condition.

National guidelines

The National Road Transport Commission is responsible for making a set of guidelines for all aspects of road transport.

- **The Load Restraint Guide 1994**
  The guide is published by the Australian Government Publishing Service and is available from:
  - The Australian Government Publishing Service in your state
  - The Federal Office of Road Safety 06 274 71 1 l
  - The National Road Transport Commission 03 9321 8444
- **Road Transport Reform (Mass and Loading) Regulations**
  - available from the Australian Government Publishing Service in your state
- **Road Transport Reform (Heavy Vehicle Standards) Regulations**
  - available from the Australian Government Publishing Service in your state

State regulations

The state regulations may differ. You need to phone the relevant authority in your state to get a copy of the current state regulations. These are currently undergoing change so that a list provided here would soon be out-dated.

Advisory manuals and leaflets

- **Australian Truck Drivers Manual**
  - National Road Transport Training Committee 03 9329 0566
- Your state Work cover Authority may issue safety guides. For example in New South Wales the following guides are produced:
  - Safety Guide for loading and unloading logs
  - Safety Guide for manual unloading of long items using a crowbar.

Company documents and policies

If you are carrying fragile, dangerous or unusual loads then there may be some particular company policies about handling, loading and tying down.

There will be general information for most of the goods transported in the form of:

- manufacturers advice
  - leaflets, manuals and brochures produced by the manufacturer giving specifications of the product relevant to loading
- your organisation's quality procedures
  - manual covering company policy and procedures for providing quality service
- your organisation's safety policy and procedures
  - company policy and procedures covering occupational health and safety and safe work practices when loading and unloading.

What are the regulations for loading a vehicle?

The mass and loading regulations apply to vehicles or combinations weighing over 4.5 tonnes and applies on all roads, footpaths, nature strips and car parking areas.

You need to know the regulations because you can be fined if your load does not comply with the regulations.

If the vehicle is overloaded or the load is not secured properly the driver and the owner are guilty of an offence.
The penalty for a single offence may be:

- up to $3000 for an individual driver or owner
- up to $15,000 for a body corporate.

You need to know the GCM or GVM of any vehicle you are loading or driving.

GCM - (Gross Combination Mass)
The sum of the maximum loaded mass of the vehicle and of any trailers or vehicles that can be legally towed at any one time, as specified by the manufacturer. The GCM is usually marked on a plate on the trailer.

GVM -(Cross Vehicle Mass)
The maximum loaded mass of the vehicle - as specified by the manufacturer or the vehicle registration authority.

The general rules for loading a vehicle are:

- You must have a suitable vehicle for the load you are going to carry.
- The mass or weight of a vehicle plus load must not exceed the GCM.
- The mass or weight of the vehicle plus any load must not exceed the GVM.
- The mass or weight on a tyre must not exceed the load capacity specified by the manufacturer.
- The mass or weight on an axle group or single axle must not exceed the limits - for details on axle limits and axle spacing, refer to the Road Transport Reform (Mass and Loading) Regulations.
- The total mass or weight of a vehicle (excluding road trains and B-doubles) must not exceed 42.5 tonnes.
- The load should not stick out more than 1.2 metres from the front, 150 mm from the sides of a vehicle.
- A warning should be attached to any load projecting more than 1.2 metres from the rear of the vehicle.
- There should be no projections from the vehicle that can cause:
  - danger to a person
  - damage to property
  - breach of the Road Transport Reform (Heavy Vehicle Standards) Regulations.
- The load should be placed on the vehicle so that:
  - the vehicle is stable
  - the load will not fall or be dislodged from the vehicle
  - the load is restrained appropriately
  - the vehicle steering performance is good
  - the vehicle braking performance is good.

The specific regulations will vary according to the:

- type of vehicle
- type of load.

You need to know the regulations for the types of loads that your organisation regularly carries.

Workplace knowledge

Who is responsible for following the regulations?

The regulations tell you what should be done, but who should do them?
The responsibility is shared between:

- the driver
- the person in charge of loading the truck
- the vehicle owner
- the freight consignor.

Some operations are the responsibility of one person; sometimes the responsibility is shared.
The responsibilities are:

- Make sure the correct vehicle is chosen for the type of load.
- Make sure the vehicle, including the trailer, in-built locking systems, etc. are in good working order.
- Provide information on the weight of the load.
- Provide information on the centre of mass of each item in the load.
- Place each item safely on the vehicle.

What are the regulations for unusual loads?

There are special regulations covering:

- loads exceeding normal limits
- dangerous goods
- live loads
  - bulk liquids
  - wet concrete
  - passengers.

The authorities listed at the beginning of this section will have the relevant state regulations covering these specialised loads.

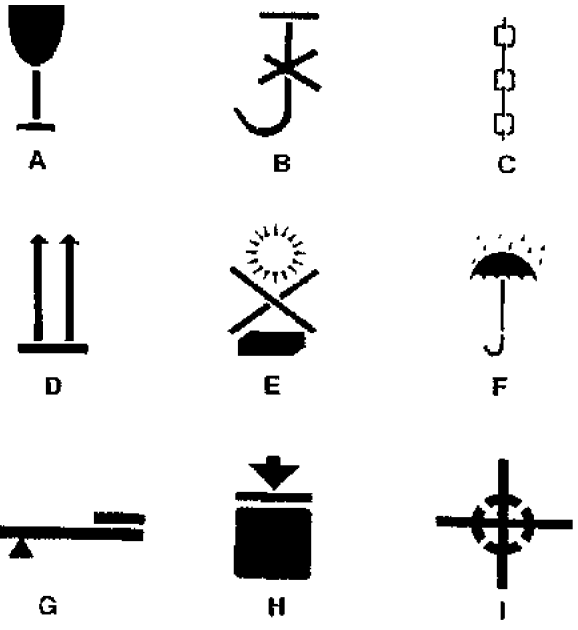
For dangerous goods the following publications are useful:

- The Australian Code for the Transport of Dangerous Goods
  - from the Australian Government Printing Service in your state.
- Users Guide To The Australian Dangerous Goods Code
  - Road Transport Training Australia (03) 9415 1891.

What are the International Cargo Symbols?

Check all sides of a box or carton for any symbols or instructions. The symbols should be large and clear and usually in the vertical faces of the load.

A – Fragile – Handle with care
B - Use no hooks
C - Sling here
D - This way up
E - Keep away from heat
F - Keep Dry
G - Heavy weight this end
H - .....kg. max
I - Centre of mass



How do you load a vehicle?

Loading a vehicle involves:

- selecting the correct vehicle for the load
- preparing the load for placing onto or in the vehicle
- arranging the load on the vehicle safely.

Preparation and planning lead to excellent and safe performance.

How do you choose the right vehicle for the job?

The vehicle must have:

- a suitable design for the load
- enough load space/area on the platform
- enough load capacity (can carry the weight).

Select the right vehicle for the job

Which of the following vehicles would you select for carrying the loads listed below?

What is the height limit for the load?

The height of the load must not be greater than:

- the limits set down in the Road Transport Reform (Heavy Vehicle Standards) Regulations
- bridges or overhead wires likely to be met on the journey.

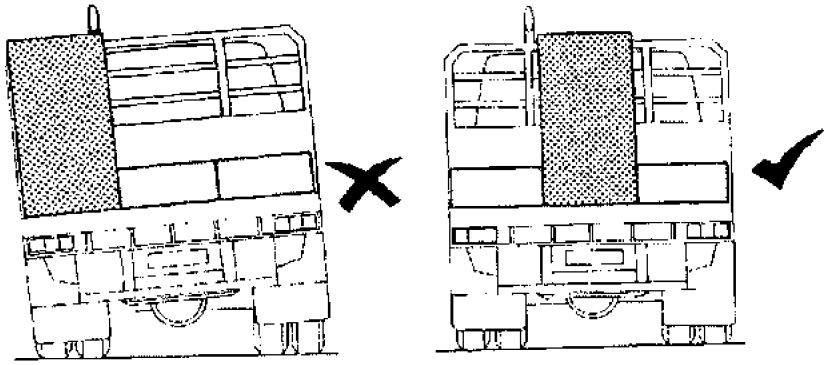
What is the weight limit for the load?

The weight of the load must not be greater than:

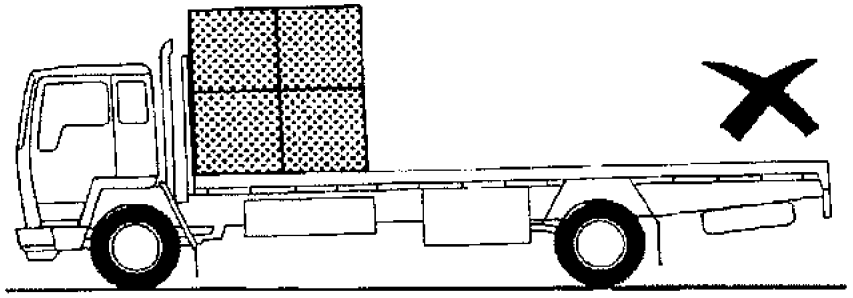
- the vehicle manufacturer's:
  - rated axle load capacity
  - rated Gross Vehicle Mass (GVM)
  - rated Gross Combination Mass (GCM), if applicable
- the requirements of the Road Transport Reform (Mass and Loading) Regulations.

How do you place the load safely?

You need to reduce the risk of overturning on corners.
To do this you need to arrange the load carefully.
The centre of mass is the centre of gravity or centre of balance of a load, or of individual items in a load.
The load should be put on the platform so that the centre of mass is as near as possible to the centreline.
Load the heaviest objects first and place them along the centreline of the platform.
A load should be positioned so that it is flush with the headboard where possible.



If the load is heavy the even distribution of weight is more important. Use dunnage or blocks to keep the load in position.



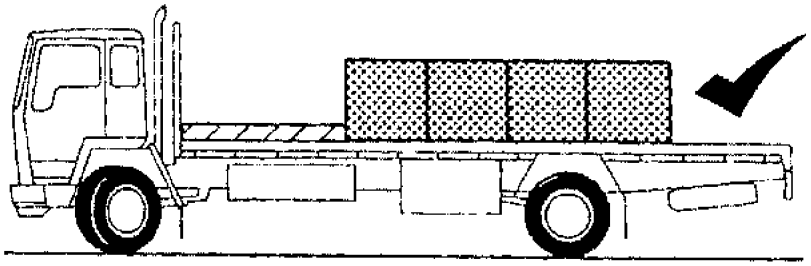
The weight should be placed as low down as possible. It is best to place heavy items next to each other along the centre line and at the base of the load.

- You need to prevent fragile items from being crushed, for example, during heavy braking.

If the load has some heavy items and some fragile items, the heavy items should be placed near the headboard and the fragile items loaded behind them.

- You need to have enough weight on steer axles.

This helps to prevent the trailer from swaying or vibrating. To do this you need to arrange the bulk of the weight in front of the rear wheels.
Put another way, the centre of mass of the load should be in front of the centre of the rear axle group of the truck or trailer.



For safe steering performance the ground weight of the steer axle of a truck or prime mover should be at least a fifth or 20% of the total ground weight of the truck over all its axles.

What other things do you need to know when loading your truck?

Check the manufacturer's specifications always. There may be information on the packaging, or leaflets or brochures provided with the goods.
Load redistribution. If you are delivering to more than one site you need to either:

- loads goods so that the partial unload can be done without affecting the mass limits or restraint requirements, or
- re-arrange the load after each delivery to ensure that you continue to comply with all the regulations.

How do you lift a load?

Depending on the type of load and the vehicle used you may have to lift the load:

- manually
- using ropes, slings and chains

- using specialised machinery.

> ***An important note:***
> Chains and ropes that are used for restraining loads are not suitable or strong enough for lifting loads. Check the ropes and chains you are using.

Manual lifting

Incorrect lifting can cause back injury.
Protect your back by learning to lift the correct way.
Always:

- check the weight of the load before you lift it
- place your feet next to the load
- get a secure grip on the load
- keep your back straight
- use the muscles in your legs to lift.

Lifting using ropes, slings and chains

Whenever you are using ropes slings or chains to lift a load you need to know the SAFE WORKING LOAD, SWL, of each piece of equipment.
For a new piece of equipment, under normal conditions, the SWL will be the WORKING LOAD LIMIT, WLL, as specified by the manufacturer.
The WWL should be displayed on any rope sling or chain you are using for lifting.

It is your responsibility to check the SWL of your equipment, which can vary from the WLL because of:

- wear
- damage
- knots
  - reduces the strength of a lifting rope by 50%
- angles
  - it is illegal to sling a load with an angle over 120 degrees
- hitches
  - can reduce the lifting strength by 20 to 50%.

Equipment for lifting has a safety factor:

Slings used to support people	10
Fibre slings (webbing and round types)	8
Fibre rope slings	6
Wire rope slings	5
Alloy chain slings	4

The working load limit is equal to the breaking load divided by the safety factor.

Safe working loads

Types of sling

You need to choose the right type of sling for your load. Chain is very strong and durable, but can damage a soft load; natural fibre rope slings fray easily and should not be used on loads with sharp edges.

These are the properties of various types of lifting sling:

- **Natural fibre rope slings**
  - easily damaged by cuts, chemicals, damp, heat and sunlight
  - need packing to protect against sharp edges
  - dry out ropes naturally
- **Synthetic fibre rope slings**
  - can stretch 40% before breaking-the snap and the recoil can cause serious injury
  - can be damaged by cuts, chemicals, heat and sunlight
- **Synthetic fibre webbing slings**
  - these include double eye slings, endless slings and slings fitted with metal end pieces
  - the outer sleeve should be made of the same material as the inner fibre so that internal damage and wear is not obscured
  - can be damaged by cuts, chemicals, heat and sunlight

- **Flexible steel wire rope slings**
  - strong light and durable
  - need to use gloves
  - can be damaged by stretch, water (rust), and chemicals
  - wire rope clips or bulldog clips must never be used to make lifting slings
- **Chain**
  - long lasting, not damaged by sharp corners, heat, water, most chemicals
  - expensive and heavy, can mark loads - needs to used with padding
  - if SWL is hard to see, you can calculate it using the formula:
    diameter x diameter x 10 = SWL kg
  - if you are sure that the chain is alloy chain grade T or 8,
    SWL Kg = diameter x diameter x 30
  - you can shorten chain using a grab hook or a clutch hook.

Safety of slings

You are responsible for the equipment that you use, before using any lifting equipment:

- check that the slings are marked with a readable WLL or SWL tag
- do not use hand spliced, untested slings
- do not use bulldog grips
- if a sling has been damaged, remove it from the working area:
  - check with the manufacturer to see if it can be repaired
  - if it cannot be used, cut it up and discard it
- inspect slings before every use
- conduct a thorough inspection every 3 months:
  - check with a full safe working load
- keep a sling register, record:
  - inspections, repairs, other relevant information such as prolonged exposure to heat, dampness.

Lifting using specialised machinery

Other methods of lifting loads include:

- fork lift machinery
- hydraulic tailgates
- cranes
- conveyors.

Operation of this type of equipment may require a separate license or certificate of competency.

How do you load unusual cargo?

This section gives some general points on loading unusual cargo.
The Load Restraint Guide will give detailed regulations about each type of cargo.
If you are moving unusual cargo you need to study the regulations and ***follow the guidelines exactly***.
You need to take care in preparing goods to be placed on the vehicle. Wherever possible goods should be packed into cases or on pallets or in secure bundles. This makes loading and securing on the vehicle easier and safer.
Most of the types of cargo dealt with here will also need to be secured, protected or restrained in some way.

Containers

When placing a load in a container the general rules apply:

- heavy goods should be spread evenly over the floor area
- light goods should be placed on top of heavy goods
- if the container is not full, the load must be secured within the container to prevent any movement during transportation.

Most containers are built to ISO standards and have corner castings for lifting and for attaching to twist-locks on specialised container carriers.
Remember that an empty container rides higher than a full one.

Cargo on pallets

Pallets should be checked regularly to make sure that they are in good condition. The pallet needs to be strong enough to carry the load.
You need to prepare pallets for loading by stacking and securing the goods so that no movement occurs on the pallet.

The pallets must then be stacked and secured on the vehicle so that they cannot move during transportation.

Construction equipment

Check the manufacturer's recommendations for loading the machine. There should be instructions for preventing movement of attachments such as buckets, jibs, booms, slewing, superstructures and cabs.
All loose items should be removed from the machine and secured to the platform of the carrier. The suspension unit of the machine should be locked.
Relieve the pressure in the hydraulic system of the machine. You can do this by moving all control levers through all positions with the engine off and the machine stowed, do this at least twice.
Cap any exhaust stacks on the machine to protect the turbo charger.
Check the clearance of a low loader, with the machine stowed, there may be danger of grounding. Clearance should not be less than 1/20th of the distance between adjacent axles.

Timber

There are different regulations for loading:

- log timber
- processed timber products.

Refer to the Load Restraint Guide Section C2 pages 61-67 if you handle this type of cargo in your workplace.

Log timber

Specialised, purpose built vehicles should be used to transport log timber. These include timber jinkers and skeletal trailers including pole trailers, skeletal semi-trailers and B-doubles.
These vehicles have special restraints fitted to ensure no movement of the logs in transportation. For example, the outer logs in a stack have to be restrained by a minimum of two stanchions.

- Place the logs end to end, this helps the load to build up evenly.
- The top outside logs should not be higher than the stanchion.
- The inner top logs may be half the log diameter above the stanchion height.
- Cradle short logs in the middle of longer logs.

Processed timber

Processed timber may be carried in loose or packaged form.
Lashings are not needed on a vehicle with head, side and tailboards of suitable strength. The timber should be loaded and packed tightly to prevent movement. (Refer to the guidelines for logs.)
Processed timber such as loose sheets of light plywood will always need to be secured as they can be moved by airflow.

Loose building materials

Some materials are carried loose, for example sand, rubbish or asphalt.
These loads need to be prepared and placed to prevent shedding.

- The body, sides, tailgates and body to chassis attachments on the vehicle should be in good condition.
- If no tarpaulin is to be fitted, the load should always be 100 millimetres below any side of the vehicle.
- Doors to bulk bins must be closed.

Pipe loads

Where possible pipes should be bundled and secured together prior to loading.
Loose pipes greater than 2.5 metres in length should be loaded lengthwise.
Metal and asbestos or plastic pipe is loaded lengthwise with hardwood layers between each layer of pipe.
The ends of the front load of pipe should be flush with the headboard.
Concrete pipe should be loaded across the vehicle, if possible given the length and weight allowances.

Live loads

A live load cannot be completely secured and can move about within the load space. For example:

- bulk liquids
- livestock
- hanging meat
- wet concrete.

The stability of the vehicle can be improved by restricting movement as much as is possible.

For bulk liquids:

- put baffles in the tank

- put the liquid in several smaller tanks
- make sure tanks are empty or full.

Livestock should be loaded in purpose built crates allowing very little movement. This reduces the risk of injury to the animal and increases the stability of the vehicle.

Dangerous goods

The person in charge of loading or unloading dangerous goods must:

- not load leaking or damaged packages
- ensure that goods are stowed according to the regulations in section 7 of the Australian Dangerous Goods Code (ADG Code)
- ensure that incompatible goods are not on the same vehicle, unless segregated by an approved device (refer to ADG Code, section 7.2.3)
- ensure that the driver has a copy of the shipping document conforming to the requirements in the ADG Code, section 4.
- ensure that the vehicle is marked clearly and correctly if required - see ADG code section 3
- follow safety precautions for entering enclosed spaces, particularly where there may be harmful dust or vapour.

What are the general rules?

Loads must be restrained to stop movement during transportation.

- The load must not become dislodged from the vehicle.
- The load should not move about on the vehicle.

The restraints that you use must be in good condition.

Restraint regulations

In order to meet the performance criteria laid out in the Load Restraint Guide, your restraints need to provide each of the following separately:

- restraining forces equal to 80% of the weight of the load to prevent the load shifting forwards (e.g. during forward braking)
- restraining forces equal to 50% of the weight of the load to prevent the load shifting rearwards (e.g. during braking in reverse)
- restraining forces equal to 50% of the weight of the load to prevent the load shifting sideways (e.g. during cornering)
- restraining forces equal to 20% in addition to the weight of the load to prevent the load moving vertically relative to the vehicle.

For example, the minimum horizontal restraint required to prevent movement of a 10 tonne load is shown in Figure C.1:

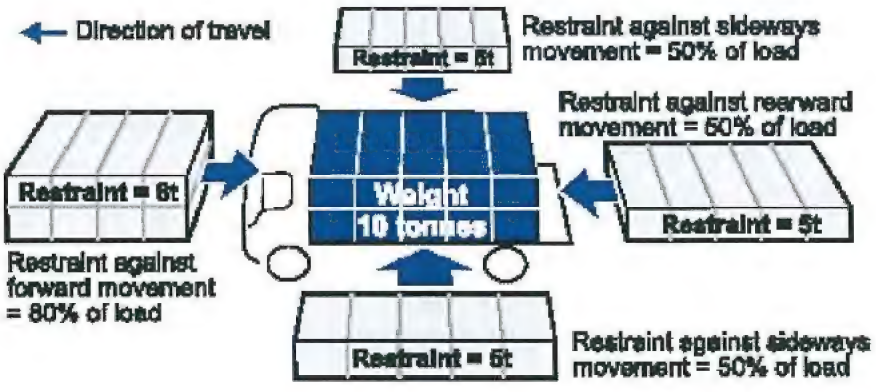


Fig. C.1 MINIMUM HORIZONTAL RESTRAINT REQUIRED

In the case of an extremely slippery load, where there is no friction, for example, steel on steel, direct lashings need to be used. In this case the strength of restraints should be:
in the forward direction = twice the weight of the load
sideways = the weight of the load
rearwards = the weight of the load.

ACTIVITY 20

Performance standards for load restraints

What are the different types of restraining equipment?

The following types of equipment are recommended for restraining loads on vehicles:

- rope
  - the most suitable rope is synthetic rope, polyethylene, made from staple fibre (silver)
  - beware of the many types of rope available which are unsafe and unsuitable for restraining loads
  - sisal and manila ropes cannot be used for securing loads on vehicles
- lashing tensioners and connectors
  - webbing, chain and wire rope lashing assemblies all require good quality , undamaged connectors and tensioners
  - powered winches are useful as they automatically self-tension during transit
- webbing assemblies
  - should be compiled of load rated material with attached or portable ratchet winches
- chain assemblies
  - high tensile chain or transport chain, yield strength 650 to 700 MPa is suitable for lashings, but not for lifting loads
  - select chain tensioners which do not 'kickback', for extra operator safety
- wire rope and attachments
  - steel wire rope, with end fittings and tensioning winches, is good for loads which may settle in transit, the lashing is more elastic and can be tightened easily
- strapping
  - steel strapping is good for lashing heavy slippery loads on to container flats
- clamps and latches
  - should have positive locking action
- timber
  - can be used for dunnage, chocks, cradles
  - should be the right shape and type for the job
  - should be free of knots and splits
  - rounded edges will prevent wear on lashings
- inter-layer packaging
  - increases the friction between layers of the load, for example, anti-slip mats
- separators
  - air bags, sometimes called pneumatic load control systems
  - take care to follow the manufacturers specifications and instructions carefully
  - rubber tyres.

What are the safety requirements?

The restraints that you use have to be strong enough to restrain the load. The measurement of the strength of the restraint is provided by a set of standards. Equipment that conforms to the standards will be marked, for example:

- Conforms to standard AS2321 1979 Short link chain for lifting purposes.
- The relevant standards are listed in the Load Restraint Guide, Appendices, Section G2.

As the standards are updated from time to time, you will need to have a current copy of the Load Restraint Guide, and current copies of the standards.

When you are buying equipment, you need to know what the current standard is, so that you do not buy or use equipment that did conform to a standard that has now been updated.

How do you select and use the equipment?

Once you have identified the different types of equipment and the safety standards for each, you need to know how to use them.

Always check your equipment for any signs of wear and tear. If you have any doubt about the condition of rope, chain, wire, strapping, webbing or attachments do not use the equipment.

More detailed information on selecting, checking and using equipment can be found in the Load Restraint Guide Section B2.

Which equipment do you use for different types of load?

- Light loads
  - rope
  - tarpaulin.

- Heavy individual objects
  - chains
  - webbing
  - steel strapping - especially for very heavy objects as this can be pre-tensioned
  - wire rope.
- Crushable loads, or loads that settle in transit
  - ropes
  - webbing.
- Timber logs
  - chain and webbing, combined.
- Sharp or abrasive loads
  - chain
  - steel strapping.

How do you use the equipment?

Lashings

- protect from wear and tear by using packing material, or sleeves where they touch other lashings or the load
- attach lashings to the vehicle at the tie rail support joint
- position winches on alternate sides of the vehicle along the load
- use separate tie down lashings
- knot ropes correctly using the round turn and two half hitches or the clove hitch and half hitch.

Webbing

- protect from sharp edges, chemicals and heat
- wind strapping evenly on winches

Chains and tensioners

- check for knots, twists and unusual joins as well as wear and tear on links
- use the correct tensioning equipment for the type of chain.

Wire rope and winches

- protect against sharp edges
- make sure the rope is not bent near a clamp or splice.

How do you do a safety check?

You need to check that:

- projection from the front, sides and rear of the vehicle are within the limits
- the mass of the total vehicle and over each individual axle or axle groups are within the limits
- the amount of restraint meets the performance standards
- the vehicle steering and braking performance is good.

CHECKLIST FOR LOADING

Checking your load

You should check your load to make sure that any slight movement is checked by re-arranging or retensioning the restraints.
Your load will exert force against the restraints every time you change the conditions.
If you are stationery and move off the load will pull backwards, trying to stay still.
If you are moving forwards and then brake the load will push forwards, trying to continue moving.
If you corner sharply, the load will pull in the direction you were originally travelling.
You need to check your load:

- before moving off
- after 25 kilometres
- when you do tyre checks
- every time you add or remove a load
- after emergency braking
- after driving over bumps
- after a sharp turn.

Check your transportation and load documentation. You should check to make sure that your load documentation has been completed in accordance with company requirements. The documentation may cover:
the necessary dangerous goods documentation

- load sheets
- invoices
- manifests
- load weight information (weigh-bridge dockets)
- licences
- consignment notes.

What are the general rules for unloading a vehicle?

Safety is the prime concern when you are unloading a vehicle.
Although you have taken the greatest care to ensure that the load has not shifted during transportation, you can never be absolutely sure that the load is as secure as when you set off.
As you are driving you need to stop to check the load at intervals. If you observe any load movement you will need to stop and unload/reload the freight.
When you are unloading a vehicle you need to:

- find a suitable unloading area
- observe the safety precautions for unloading.

Find a suitable unloading area

If you are on the destination site you will be directed to the unloading bay.
If you have to unload on a public road you need to:

- be aware of your own personal safety
- find a level site where possible
- if you have to park on a slope
  - chock all the wheels on one axle
  - turn the steering wheel to full lock
- switch on the parking lights
- barricade off the unloading area.

Safety precautions while unloading

- Walk around the vehicle checking the load and the restraints for any sign of movement or damage.
- Clear the area of personnel.
- Untension winches and tensioners slowly, watching for any movement of the freight
- Remove restraints or open doors slowly, watching for any movement of the freight.
- Unload from the right side of the vehicle first. Road camber tends to make freight shift slightly to the left.
- Make sure that all dock levellers, bridge plates, vehicle tail lifts are in good working order, keep your hands clear of machinery.
- If you are only taking off part of the load re-arrange your load to comply with regulations.
- Clean the platform, pack away all equipment.

HEAVY VEHICLE QUESTIONS – DEPT OF TRANSPORT

1. What is the maximum mass that may be carried on a single axle with dual tyres other than an omnibus?

   Answer: 9000kg.

2. What is the maximum speed limit in the built-up area, unless otherwise indicated, for a vehicle that weighs more than 4.5 tonnes?

   Answer: 50km/h.

3. What is the maximum permissible height of a vehicle and its load, other than a livestock trailer?

   Answer: 4.3 metres.

4. A heavy vehicle of which the mass, together with any attached trailer and the total load carried (if any), exceeds 12 tonnes is compelled to carry certain emergency equipment, if outside a built-up area. What is this equipment?

   Answer: 3 portable warning signs complying with the relevant Australian Standards.

5. What is the permissible width, including the load, of any vehicle?

   Answer: 2.5 metres maximum.

6. What are the requirements in regard to any extra mass or oversize permit which may be issued?

   Answer: The permit must be carried in the vehicle and be produced on demand when requested by any police officer or other authorised person.

7. When must a trailer be equipped with break away brakes?

   Answer: Where the gross mass exceeds two tonnes or it is a semi-trailer or pole type trailer.

8. What is the maximum speed limit for a vehicle, the gross vehicle mass of which taking into account any trailer attached and including the total load carried, is more than 12 tonnes?

   Answer: 100km/h.

9. Is it permissible to tow a trailer behind an articulated vehicle?

   Answer: Not without the written permission of the Commissioner of Main Roads.

10. What are the provisions with regard to condition of mudguards?

    Answer: They shall be in good condition, free from cracks and sharp or jagged edges.

11. What is the maximum permitted length of an articulated vehicle and its load?

    Answer: 19.0 metres.

12. What is the permissible overall length, including the load, of any rigid vehicle, other than an omnibus?

    Answer: 12.5 metres.

13. What is the maximum mass that may be carried on a single axle with single tyres, other than an omnibus?

    Answer: 6000kg.

14. What must you do when you desire to carry an overwidth, overheight, or overlength load or a load exceeding that for which the vehicle is licensed?

    Answer: Obtain a permit from the Commisioner of Main Roads, or appointed agent.

15. If you are hauling a load greater than your licence permits, what may you be compelled to do in relation to the overload, either where you are stopped or at a specified place?

    Answer: Off load the excess.

16. Regarding vehicle weight, what information is printed on the registration sticker for a vehicle licensed as a goods vehicle?

    Answer: Gross Vehicle Mass (GVM), Gross Combination Mass (GCM) and Manufacturers Gross Combination Mass (Man-GCM).

17. In the event of a disabled heavy vehicle being left on a carriageway outside a built-up area during the hours of darkness, in what position must the portable warnings signs be placed?

    Answer: One sign must be placed beside the vehicle, and one each to the front and rear at a distance of not less than fifty metres or more than one hundred and fifty metres. Wherever practicable, at least one sign must be visible to an approaching driver at a distance of not less than two hundred metres.

Basic Fatigue Management

Operators with Basic Fatigue Management (BFM) accreditation can operate under more flexible work and rest hours, allowing for (among other things) work of up to 14 hours in a 24-hour period. BFM gives operators a greater say in when drivers can work and rest, as long as the risks of driver fatigue are properly managed.

Basic Fatigue Management – work and rest hour requirements

The below table applies to solo drivers.

Time	Work	Rest
In any period of…	A driver must not work for more than a maximum of…	And must have the rest of that period off work with at least a minimum rest break of…
6 ¼ hours	6 hours work time	15 continuous minutes rest time
9 hours	8 1/2 hours work time	30 minutes rest time in blocks of 15 continuous minutes
12 hours	11 hours work time	60 minutes rest time in blocks of 15 continuous minutes
24 hours	14 hours work time	7 continuous hours stationary rest time*
7 days	36 hours long/night work time**	
14 days	144 hours work time	24 continuous hours stationary rest time taken after no more than 84 hours work time and 24 continuous hours stationary rest time and 2 x night rest breaks# and 2 x night rest breaks taken on consecutive days.

**Stationary rest time is the time a driver spends out of a regulated heavy vehicle or in an approved sleeper berth of a stationary regulated heavy vehicle.*
***Long/night work time is any work time in excess of 12 hours in a 24 hour period or any work time between midnight and 6 am (or the equivalent hours in the time zone of the base of a driver).*
#Night rest breaks are 7 continuous hours stationary rest time taken between the hours of 10pm on a day and 8am on the next day (using the time zone of the base of the driver) or a 24 continuous hours stationary rest break.

Download a BFM daily work and rest hours planner for solo drivers.

The below table applies to two-up drivers.

Time	Work	Rest
In any period of...	A driver must not work for more than a maximum of...	And must have the rest of that period off work with at least a minimum rest break of...
24 hours	14 hours work time	
82 hours		10 continuous hours stationary rest time
7 days	70 hours work time	24 continuous hours stationary rest time and 24 hours stationary rest time in blocks of at least 7 continuous hours of stationary rest time
14 days	140 hours work time	4 x 7 night rest breaks#

**Stationary rest time is the time a driver spends out of a regulated heavy vehicle or in an approved sleeper berth of a stationary regulated heavy vehicle.*
#Night rest breaks are 7 continuous hours stationary rest time taken between the hours of 10pm on a day and 8am on the next day (using the time zone of the base of the driver) or a 24 continuous hours stationary rest break.

BFM Standards

There are six fatigue management standards that you need to comply with for BFM:

1. **Scheduling and rostering** – standard scheduling of individual trips and rostering of drivers are to be in accordance with limits prescribed in legislation
2. **Fitness for duty** – standard drivers are in a fit state to safely perform required duties and meet the specified medical requirements
3. **Fatigue knowledge and awareness** – standard personnel involved in the management, operation, administration, participation and verification of the BFM option can demonstrate competency in fatigue knowledge relevant to their position on the causes, effects and management of fatigue and the operator's fatigue management system
4. **Responsibilities** – the authorisations, responsibilities and duties of all positions involved in the management, operation, administration, participation and verification of their operations under the BFM option are current, clearly defined, documented and carried out accordingly
5. **Internal review** – an internal review system is implemented to identify non-compliances and verify that the activities comply with the BFM standards and the operator's fatigue management system
6. **Records and documentation** – the operator will implement, authorise, maintain and review documented policies and procedures that ensure the management, performance and verification of the BFM option in accordance with the standards.